

UNIVERSITY OF BAHRAIN
COLLEGE OF INFORMATION TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE

ITCS 322 – Operating Systems

Midterm Examination
Second Semester, 2014-2015

Date: 20-APRIL-2015

Time Allowed: 75 Minutes

Section	[1] [2]✓ [3]	<i>Please tick one</i>

Question 1	15	14.5
Question 2	10	10
Question 3	12	10.5
Question 4	15	14.5
Question 5	18	17.5
TOTAL	70	67

Notes:

- Please make sure that you write your FULL NAME, ID and Section number before you start the paper.
- Write your answers in the space provided for the purpose.
- You must switch off your mobile before starting the examination.

Question 1.

[15 Marks]

What is system software?

[2 Marks]

It is a collection of programs that controls the activities and functions of the various hardware components, programming tools and abstractions and other utilities to monitor the state of the computer like: linkers, loaders, assemblers, operating systems, editors.

What a bootstrap program does?

[2 Marks]

It initiate all aspects of the system and it loads system kernel and start execution.

Below is a list of features that are provided by different types of operating systems. Write the type of operating system against each feature specific to that operating system. [4 Marks]

Feature	Type of operating system
Process synchronization	time-sharing system ✓
Sharing external storage	clustered systems ✓
File sharing	networking system ✓
Meeting deadline	Real-time systems. ✓

What is multiprogramming? Explain how it works.

[3 Marks]

In multiprogramming the system can execute more than one program at a time. a single program can't keep CPU busy all time, however these systems organize jobs so that a CPU runs one process at a time, multiple jobs are kept in main memory and the CPU is multiplexed among them. When the process is waiting for an input/output, the CPU can switch to other process.

What is difference between client-server and peer-to-peer systems?

[2 Marks]

In client server one ^{node} peer can be a client requesting for a service from a server, and the ~~se~~ other ^{node} peer is the server. but in peer-to-peer all nodes can be client or server or both (requesting services and giving services).

Which type of clustered system (Asymmetric or Symmetric) is more suitable for heavy loads and why? [2 Marks]

Asymmetric clustering because in it one process is running the application while the other stand-by - but in Symmetric all nodes ~~play~~ run the application at the same time so it is not suitable for heavy loads to run all at one time.

Question 2.

[10 Marks]

Write ANY FOUR activities performed by the process manager.

[2 Marks]

1. Create, ~~and~~ delete, ~~&~~ Suspend, resume processes

2. Provide mechanism for process synchronization

3. " " " deadlock handling

4. " " " process communication

Which OS component is responsible for mapping files on to the secondary storage? [1 Mark]

File management

Why main memory is called a volatile memory?

[1 Mark]

because it doesn't keep the data when the system shutdown.

How do we request an operating system service?

[1 Mark]

by system call or message passing

What does a command interpreter do?

[2 Marks]

It reads the next command statement and interpreter ~~then~~ and execute them.

What happens when you make a system call? [3 Marks]

The system call is translated into trap instruction which switch the CPU mode into supervisor mode and reach into trap handler which discover which OS function is being requested, then the OS evaluate parameters, execute and return to user mode (return to application)

- In short:
1. The Process traps to trap handler
 2. Supervisor mode set
 3. function executed by OS.
 4. return to application.

Question 3.

[12 Marks]

Explain, with an example, how memory can be protected?

[5 Marks]

The memory can be protected by

using two registers: base register and limit register. These registers are used to check if the process address is legal or not.

For example if the base register which indicates the start of the address is ~~equal~~ equal to 1000 and the ~~base~~ limit register is equal to 500 (it indicates the size of the address)

then the process should be assigned to address ≥ 1000 and $\leq (1000 + 500)$.

2. load-base and load-limit should be ~~privileged~~ privileged instructions.

Assume the CPU is executing a program that is loaded in the memory with starting address 2500 and a size of 400 bytes. What will be the values of the BASE register and LIMIT register? Will the executing program be able to access the memory location 2800? Explain. [3 Marks]

Base register 2500 limit register 1000

~~limit register~~ ^{last address accepted (legal) =} $2500 + 400 = 2900$

yes, the program will be able to access the memory

2800 because ~~it is~~ $2500 < 2800 < 2900$

What does a trap instruction do?

[2 Marks]

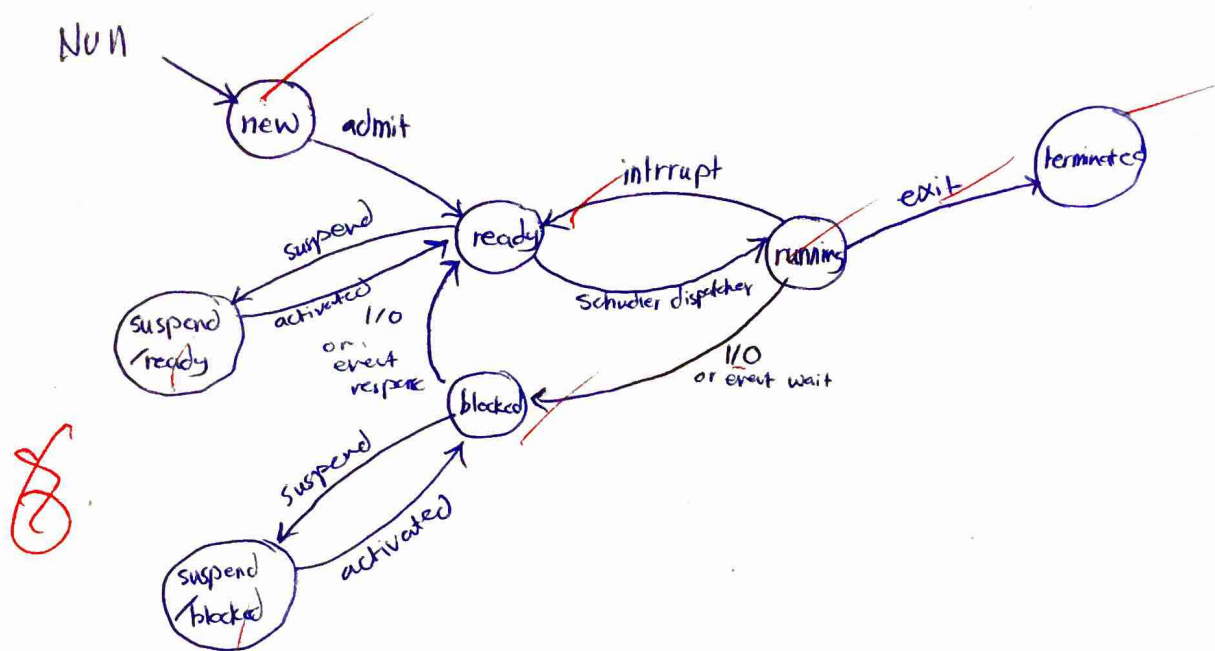
It switches the CPU mode into supervisor mode and reach into trap handler which discovers which OS function is being requested, then OS evaluate the parameters, executes the function and return to user mode.

What is an interrupt vector table and an interrupt handler? [2 Marks]

- The Interrupt vector table is the table that stores the interrupts ID and pointer, used when ^{dealing with} ~~the~~ ~~handling~~ multiple interrupts.
- The interrupt handler is the Program that indicate the nature of the ~~the~~ interrupt and do whatever action needed.

Question 4. [15 Marks]

Draw a process state transition diagram (with suspend state). Write the states and events that cause a state change. [6 Marks]



Write any TWO events that can cause an abnormal termination (abort) of a process. [2 Marks]

- When a Parent Process terminates, all child Process terminated.
- requesting Privileges Privileged instruction or illegal instruction.

What is a PCB? What information is generally stored in it? [3 Marks]

Process control block. each process created in the system is given a PCB which stores information about the Process, these information includes: PID (Process ID), UID (user ID who created the Process), PPID (Parent ID), Process state (ready, new, blocked, ...), Program counter, a list of I/O given to this Process, ... etc.

Specify the queue in which a process will be moved upon each of the following event? [4 Marks]

A running process issues an I/O request (to print)

Device queue

A new process is created.

job queue

A process is loaded in to the memory.

ready queue

A running process gets interrupted.

ready queue

Question 5.

[18 Marks]

What is difference between an I/O bound and a CPU bound process? [2 Marks]

- 1. I/O bound processes have very large number of short CPU burst.
- 2. CPU bound process have very few long CPU burst.

What is the common feature in FCFS and SJF CPU scheduling algorithms?

[1 Mark]

both are Preemptive schedulers.

What are TWO disadvantages/drawbacks of SJF algorithm? [2 Marks]

- 1. Worst ^{shortest job first} average waiting time case.
- 2. Convey effect: short processes behind long processes.
- 1. determining the time of CPU burst is hard (many ^{measuring} problems)
- 2. starvation ^{for} long processes.

What is a dispatcher and its function? [3 Marks]

used when the control of CPU is given to the process.

its functions:

- 1. switch context
- 2. switch to user mode.
- 3. go to appropriate ~~prog~~ location and restart program.

Consider the following scenario. A process arrives in the ready queue and waits there for 10 ms before it gets the CPU. It executes for 5 ms and is interrupted. It waits in the ready queue for 5 ms before it gets the CPU again. The process executes for another 4 ms and then terminates. What is the turnaround time of the process? Show your calculations. [3 Marks]

Turnaround Time = Service time + Waiting time ~~to time~~ ~~to time~~

$$= (5\text{ms} + 4\text{ms}) + (10\text{ms} + 5\text{ms})$$

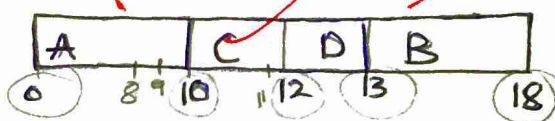
$$= 9\text{ms} + 15\text{ms} = 24\text{ms}$$

turnaround time : the time interval between submission and completion = 24 ms

Consider the following processes and their arrival and service time

Process	Arrival time	Service time
A	0	10
B	8	5
C	9	2
D	11	1

Show the Gantt chart and the calculated the average waiting time if the above processes are executed using shortest remaining time first algorithm. Show your calculations. [7 Marks]



Waiting time = start time - arrival time

$$A = 0 - 0 = 0$$

$$B = 13 - 8 = 5$$

$$C = 10 - 9 = 1$$

$$D = 12 - 11 = 1$$

average waiting time = $(0 + 5 + 1 + 1) / 4$

$$= 7 / 4$$

$$= 1.75$$

When new process arrive
If the CPU burst
service time of new process <
remaining time of current process

- preempt current process
- assign CPU to new process

B 1.5 X 2
C 2.2 X 1
D 3.1 X 1

